The Economic Impact of Secondhand Smoke on the Health of Residents and Employee Smoking on Business Costs in Marion County, Indiana for 2000

A Report for the Marion County Health Department

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EXECUTIVE SUMMARY

Exposure to secondhand tobacco smoke (SHS) is a significant contributor to adult and childhood morbidity and mortality in the U.S. To fully understand the economic impact of tobacco use, the health costs of primary smoking and exposure to SHS need to be considered along with the costs to businesses of employees who smoke. This study estimated the health costs of SHS exposure to residents and the economic impact of employee smoking on businesses in Marion County.

Estimates of the number of cases were based on national attributable risk data for diseases that are causally related to exposure to secondhand smoke for both adults and children. The following diseases were included for adults: lung cancer, nasal sinus cancer, heart disease, stroke, cervical cancer and asthma; and for children: sudden infant death syndrome, respiratory syncytial virus bronchiolitis, acute otitis media, otitis media with effusion, asthma, low birth weight, and perinatal death. Burns due to fires caused by smoking were included. Hospitalization costs and outpatient costs of these diseases were estimated using Indiana hospital discharge and national outpatient data. Disease specific death rates and low birth weight rates were based on Marion County vital statistics. A national value of life rate was used to estimate the cost of premature death. To calculate the costs to businesses from employee smoking, a national cost estimate was used that included the costs of higher health insurance premiums, lost productivity, absenteeism, as well as recruitment and training costs resulting from premature death and disability of employees resulting from smoking. All costs were adjusted to year 2000 dollars.

During 2000, at least $16.7 million were spent for the hospitalization and health care of Marion County residents with SHS exposure-caused diseases: $6.2 million for adults and $10.5 million for children. Additionally, at least $39.5 million were lost due to premature death that can be attributed to SHS exposure: $19.2 million for adults and $20.3 million for children. Combined, the costs of health care and the costs of premature loss of life for diseases attributed to SHS in Marion County were estimated to be at least $56.2 million in 2000. These costs do not include the health care and loss of life costs of Marion County residents who were smoking themselves. In addition, employees who smoked cost Marion County businesses an additional $260.1 million dollars in increased health insurance premiums, lost productivity, fires, absenteeism, and extra housekeeping .

The results of this study should be used by policy makers and businesses to:

- Educate the public, as well as community leaders and policy makers, about the health impact and costs of SHS in Marion County;
- Develop strategies to totally eliminate smoking on business and institutional campuses including schools, colleges and universities, day care centers, restaurants and other food or beverage service establishments;
- Strictly enforce no smoking restrictions in all public areas, and on business and school campuses;
- Provide more support for smoking cessation by businesses, health departments and health care providers; and,
- Encourage smokers not to smoke in shared areas.

INTRODUCTION

Exposure to secondhand tobacco smoke (SHS), also known as environmental tobacco smoke, passive smoking, and involuntary smoking, is a significant contributor to adult and childhood morbidity and mortality in the United States.[1-4] SHS is a complex mixture of gases and particles comprised of smoke from burning cigarettes, cigars or pipe tobacco (side stream smoke), as well as mainstream smoke that is not inhaled by the smoker, and exhaled smoke. Secondhand smoke contains at least 250 chemicals known to be toxic or carcinogenic.[1] Exposure of nonsmokers to SHS in adulthood has been causally associated with many medical conditions, including lung, nasal sinus and cervical cancer, decreased pulmonary function, heart disease (myocardial infarction and arteriosclerosis), stroke, eye and nasal irritation, spontaneous abortions, and asthma.[2-3] In addition, other studies have suggested exposure to SHS may be causally associated with breast cancer, adult leukemia, angina pectoris, hearing loss, allergies, surgery/anesthesia risk, periodontal disease, dysmenorrhea, colds, pneumonia, meningococccal disease, congestive heart failure, and cardiac arrhythmia.[2, 5-18, 20-29] Exposure of children to SHS has been linked to low birth weight, sudden infant death syndrome, respiratory syncytial virus bronchiolitis, asthma exacerbations, otitis media, chronic respiratory symptoms, cystic fibrosis exacerbation, Legg-Perthes disease, meningococcal disease and cognitive/behavioral impairment.[2-4,19,24-25] Also, many children are injured from fires started by smoking.[4]

SHS exposure in Indiana is a major public health concern for several reasons. First, the adult smoking rates in Indiana and Marion County are higher than the nation as a whole. While the rate of smoking among adults in the U.S. is 23.2 percent, Indiana's

adult smoking rate is 26.9 percent and Marion County's rate is 28.2 percent.[30-31] Second, Indiana's children are exposed to the effects of smoking before birth at a rate higher than the national rate. The national rate of smoking among pregnant women is 12.3 percent, while the Indiana rate is 20.9 percent and the rate in Marion County is 19.7 percent.[32-34] Third, it has been estimated that 27.5 percent of children in Indiana are exposed to SHS in the home, compared to 22 percent nationally.[35] Although numerous studies examining the link between SHS exposure and adult and child morbidity and mortality have been published, little has been published regarding the economic consequences of these adverse health effects.

In addition to the health effects of SHS, employees smoking in the workplace also represent significant costs to businesses.[36-38] To fully understand the economic impact of tobacco use, the health costs of primary smoking and exposure to SHS need to be considered along with the costs to businesses of employees who smoke.

The purpose of this report is to estimate the economic costs of SHS exposure to the residents of Marion County, Indiana. The morbidity and mortality costs of SHS will be presented separately for both adults and children. In addition, this report provides an estimate of the economic impact of employee smoking on businesses in Marion County. Estimating the costs of the health effects of primary smoking is beyond the scope of this report.

METHODS

The estimates of the number of cases of disease caused by SHS exposure reported in this study were developed using existing national attributable risk data for diseases that have been associated with exposure to secondhand smoke for both adults and children.[2-4]

For adults, this study included those conditions for which there is substantial evidence that cases can be attributed to exposure to SHS: cancer of the lung, nasal sinus, and cervix; heart disease, both myocardial infarction and arteriosclerosis; stroke; and asthma. Likewise, for children, this study included only those diseases for which smoking by the parents or others in the household has been clearly identified as an attributable factor: sudden infant death, RSV, acute otitis media, otitis media with effusion, asthma, low birth weight, and perinatal death. Burns among children from fires caused by smoking were also included.

Attributable risk is the rate of a disease or other health outcome in exposed individuals that can be attributed to their exposure to that risk factor, in this case, secondhand tobacco smoke. Since some non-exposed individuals are also likely to contract the diseases under study, attributable risk measures the excess rate of those diseases when individuals are exposed, over what we would have expected if the individuals had not been exposed. The attributable risk is determined by subtracting the rate of disease or mortality among the unexposed individuals from the rate of disease or mortality among the exposed individuals. In well-designed studies, it can be assumed that risk factors other than the one under investigation have equal effects on the exposed and unexposed groups.

The disease specific hospitalization costs of the targeted diseases for adults were estimated using hospital discharge dataset collected by the Indiana Hospital and Health Association. The hospital cost figures reported in this study are not the resource costs the hospitals incurred in caring for these patients, but the total hospital charges to the patient for the treatment of these diseases. The hospital discharge data and the mortality data for

adults (from the Marion County death certificate dataset) were for 1999. The estimates of deaths and health care utilization for children in Marion County were based on national rates reported in a 1997 study [4]. Estimated costs from premature loss of life were generated using national life expectancy data and published estimates of the value of life. [39-40] Life expectancy is the median age at time of death for a specific year. For this study, the U.S. life expectancy estimated by CDC, National Center for Health Statistics for 1999 (76.7) was used to determine the number of years of loss of life.[41]

The costs to businesses were based on published estimates of the costs to business per smoking employee. [37-38] The number of employees in Marion County was for the year 2000.

All dollar values for health care, loss of life and business costs were adjusted to be equivalent to 2000 dollars.[42,43] The cost adjustments added the applied consumer price index or medical care price index increases for each year between the date of the report and the year 2000 to the values in the original report.

SHS ADULT MORBIDITY AND MORTALITY COSTS:

Several steps were performed to assign dollar values to the adult morbidity and mortality costs in Marion County attributable to exposure to secondhand tobacco smoke. The information needed to calculate these costs were: the disease-specific attributable risk for SHS, the number of hospitalizations for the specific diseases, the average hospitalization charge for the specific diseases, the number of deaths for the specific diseases, an estimate of the value of life, life expectancy, and the average age at death for the specific diseases.

Attributable risk values used in this study for lung cancer, cervical cancer and heart disease were the median attributable risk values reported in studies cited for each respective disease as published in the California EPA report[2]. The SHS-related attributable risk estimate for nasal sinus cancer was obtained from Repace et al.[44], the attributable risk for stroke was obtained from Repace, et al.[44] and You, et al.,[45] while the attributable risk for asthma was obtained from Coultas.[46]

The 1999 Marion County hospital discharge and mortality data were obtained from the Marion County Health Department. While morbid conditions result in many types of contacts with the health care system (doctor's visits, hospitalizations, pharmacy, etc.), only hospitalization data were available for the adult population. Thus, for this study, hospitalization costs only were calculated and reported for adults with the targeted conditions. The formula used to calculate the hospital costs was:

$$HCSHS \text{ (hospital costs attributable to SHS)} = (AR * H)*CH$$

Where:
AR is the attributable risk of getting the disease from exposure to SHS;
H is the number of hospitalizations in Marion County for the specific disease;
CH is the average charge per hospitalization for the specific disease, adjusted to 2000 dollars.

The hospital costs were adjusted to year 2000 dollars using the medical care category of the consumer price index from 1999 to 2000.[42] To determine the loss of life costs, the estimated monetary value of life was obtained from two citations from the United States Department of Transportation.[39-40] The mean of the values provided, after conversion to year 2000 dollars, was used to estimate the economic value of a human life. The consumer price index for all urban consumers was used to convert values to 2000 dollars.[43] The median ages at death from the above-listed causes in Marion County were

obtained from the Marion County Health Department's 1999 death certificate data. This median age value was subtracted from the average U.S. life expectancy of 76.7 years for 1999 and divided by this average life expectancy (76.7 years) to determine the percentage of life lost. This percentage of life lost was multiplied by the value of life estimate and then multiplied by the number of SHS attributable deaths for each illness to obtain an estimated dollar value for the SHS-attributable loss of life.

The loss of life costs for each condition attributed to secondhand smoke were calculated using the following formula:

LLCSHS (loss of life costs attributable to SHS) = (AR * D) * {VL * [(LE – AD)/LE]}

Where:
AR is the attributable risk of getting the disease from exposure to SHS;
D is the number of deaths in Marion County for the specific disease;
VL is the value of life estimate;
LE is the life expectancy; and,
AD is the average age of death for the specific disease.

The total health-related costs for adults attributable to SHS would be the sum of the hospitalization costs and the loss of life costs: TCSHS = HCSHS + LLCSHS.

SHS CHILD MORBIDITY AND MORTALITY COSTS:

Using Aligne and Stoddard's [4] model, the number of office visits, hospitalizations, surgeries and deaths of each SHS-related pediatric illness and the resulting costs were computed for Marion County residents. For each condition, a ratio was applied, using the values reported in the Aligne and Stoddard study and the total United States population [47] for the particular age group, to the Marion County population[47] for that age group to obtain an estimation of the number of events for each SHS-related disease in the Marion County population. This formula was used:

$$E_{MC} = P_{MC} * (E_{US} / P_{US})$$

Where:
E_{MC} is the estimated number of events in the sub-population of children in Marion County for the applicable disease;
P_{MC} is the number in the applicable sub-population of children in Marion County;
E_{US} is the number of events in the U.S. for the disease in the applicable sub-population; and,
P_{US} is the number in the applicable sub-population in the U.S.

This calculation was used to determine an estimate of the initial number of events for the Marion County population. The attributable risk estimates, also reported in the Aligne and Stoddard article [4] were then applied to the estimated number of events in Marion County to obtain an estimate of the number of events among Marion County youth that can be attributed to SHS exposure, using the formula:

$$E_{SHS} = AR * E_{MC}$$

Where:
E_{SHS} is the number of events in Marion County attributable to SHS;
AR is the SHS attributable risk of getting the disease from exposure to SHS; and
E_{MC} is the estimated total number of events in Marion County among both the exposed and non-exposed applicable sub-populations.

Before applying the costs per case estimates reported in the Aligne article to the number of events, the costs were adjusted to year 2000 dollars, using the medical care category of the consumer price indices from 1993 to 2000.[42] Finally, the cost estimates for the SHS attributable events were determined by multiplying the costs per event by the number of SHS attributable events in Marion County, using the formula:

$$C_{SHS} = C_E * E_{SHS}$$

Where:
C_{SHS} is the cost attributable to SHS for the disease in Marion County;
C_E is the cost per event (doctor's visit, hospitalization, surgery, etc.) for each disease adjusted to 2000 U.S. dollars; and,

E_{SHS} is the number of events related to each of the diseases in Marion County attributable to SHS.

For example, the number of office visits for otitis media for children less than 14 years old, as reported in the Aligne and Stoddard article,[4] was divided by the total number of children less than age 14 in the United States (using 2000 census data) to get a national rate of office visits by children in this age group with otitis media. This rate was then multiplied by the total number of children less than 14 years of age in Marion County from the 2000 census to obtain the estimated number of office visits for otitis media in Marion County (74,500). Next, this estimated number of office visits was multiplied by the attributable risk value reported in the Aligne and Stoddard [4] study (14%) to obtain the estimated number of otitis media office visits attributed to SHS (10,560). Finally, this number was multiplied by the estimated cost per office visit, adjusted to 2000 dollars ($58) in order to obtain the total cost of otitis media office visits among children less than 14 years old, attributed to SHS in Marion County ($607,000).

SMOKING-RELATED BUSINESS COSTS:

The direct costs to employers include health care costs associated with smoking reflected in health insurance premiums, while the indirect costs include lost productivity, absenteeism, as well as recruitment and training costs resulting from premature death and disability of employees who smoke. Thus, estimating the cost to employers of employees who smoke is not a simple matter as there are many factors and variables that need to be considered. The development of a specific estimation model of the costs of employee smoking in Marion County is beyond the scope of this report. However, it was possible to use the most frequently cited estimates of business costs for employee smoking from a

low of $722 to a high of $1,300 [38] (adjusted to 2000 dollars) to arrive at an estimate for Marion County. The published figures were inflated using the annual consumer price index for urban consumers.[43] The U.S. Bureau of Economic Analysis [48] provided the number of employed individuals in Marion County as of July 2000.

STUDY LIMITATIONS:

This report is intended to serve as an estimation of the costs of SHS in Marion County using data and models reported in several published studies. However, the costs are underestimated because data were not available to allow a full accounting of the impact of SHS in the total cost estimates. Additional data is needed on all outpatient medical care and pharmacy costs, indirect costs of poor health, and other diseases caused by SHS exposure.

Additional data are needed on outpatient medical care for diseases or conditions caused by SHS exposure. To estimate the total health care costs of SHS attributable diseases, it is important to completely measure the health care utilization of individuals with these diseases. However, data are not currently available to measure many of the health care costs. This study used only those data that were available – hospitalizations for adults and estimates of physician visits, surgeries, hospitalizations, and some medications for children. Outpatient care, emergency care and pharmacy costs for adults were not included in the cost estimates in this report, nor were outpatient care (other than physician visits), emergency care and most pharmacy costs for children. If more complete data were available, the cost estimates of health care for SHS attributable conditions would be substantially higher. For example the National Heart, Lung and Blood Institute estimated that the hospitalization costs for asthma represents only half of

the direct health care costs for asthmatics and one-third of the total (direct and indirect) costs of asthma.[49]

In addition, the estimated costs of the SHS related diseases in this study did not include the indirect costs of pain and suffering, the value of the quality of life (including annoyance), or loss of income. If these costs were included, the economic impact of SHS would be significantly higher. The costs for additional health care from existing conditions that were exacerbated by exposure to SHS were not estimated in this study. Exposure to SHS is known to exacerbate asthma and cystic fibrosis symptoms, for example. Undoubtedly, there would be additional costs for medical care for exacerbated symptoms caused by SHS exposure, but no reliable methods for estimating this effect were available.

While this approach used the most recently available findings, many of these studies were conducted several years ago. Since the changes in disease incidence and medical practice patterns are dynamic, using data from earlier studies may not accurately represent the present. Epidemiological research establishing the role of SHS exposure in causing specific diseases is still developing, however at this point many major diseases have been clearly identified as being caused by exposure to SHS. Secondhand smoke contains known human toxicants and carcinogens and is among the most toxic substances to which humans are exposed.[1-4] In addition, there is no "safe level" of exposure to SHS. Therefore, as research continues, additional diseases will likely be identified as being as being caused by SHS exposure.

Other data limitations have an unknown impact on the cost estimates presented in this report. The disease prevalence and cost estimates presented in this report were based

on studies conducted in areas other than Marion County. While these findings may not portray the true impact of SHS on the health of residents in Marion County, it is unlikely that any differences would be large. Economic calculations for loss of life are a controversial issue and there are many different approaches used to account for different factors related to the value of life. Approaches other than the one used in this study would result in different amounts for the cost estimates for loss of life.

Business costs of employee smoking cannot be easily separated into those associated with primary smoking and secondhand smoke. Thus, this report focuses on the costs to the business when employees smoke as compared to if they did not smoke. The cost estimate per employee used in this study was developed using 1980 data, however, it is the most recent estimate available in the literature. This estimate needs to be updated using current business practices and business costs.

Although limitations were encountered in conducting this study, the authors believe the results that presented are significantly underestimated, but the values here can be justified using published studies. It is the best conservative estimate of the costs of SHS in Marion County that can be obtained given the current availability of data, the state of the art, and the resources available.

RESULTS

SHS ADULT MORBIDITY AND MORTALITY COSTS:

Table 1 presents the estimated incidence, attributable risk, and costs of hospitalizations and loss of life for SHS related medical conditions for adults in Marion County. The overall cost of hospitalizations for adult Marion County residents attributed to SHS was estimated to be $6.2 million. The loss of life costs for these same conditions

was estimated to be $19.2 million. Combined, the SHS morbidity and mortality costs for adults attributed to SHS totaled $25.4 million dollars in Marion County.

The costs of morbidity and mortality associated with SHS are borne by many. Employers bear additional costs for health insurance premiums and self-insured employers may bear the full cost for their employees and families. Consumers may bear costs of SHS associated with their portion of insurance premiums and additional coinsurance and/or co-payments associated with the hospitalization, physician and pharmaceutical costs. Taxpayers bear much of the cost burden for SHS for the uninsured population through those tax dollars that pay for Medicaid benefits to those individuals. Additionally, society as a whole bears the burden of loss of life. The lost productivity and opportunity cost of losses related to contributions to society that would have been made are borne for many years.

The costs are distributed among the seven SHS related illnesses as follows:

Lung Cancer: The link between primary smoking and lung cancer is unequivocal.[1-3] Scientific evidence also indicates that SHS is a significant contributor to morbidity and mortality of lung cancer in non-smokers. The attributable risk of SHS exposure in the development of lung cancer was estimated to be 4.9 percent.[2] This converts to 25 hospitalizations and 29 deaths of lung cancer patients in Marion County attributable to second-hand smoke. For lung cancer, the resulting costs attributable to SHS were estimated to be $8.4 million, including $411,000 in hospitalization costs and $7,974,000 in premature loss of life costs.

Nasal Sinus Cancer: The SHS-attributable risk for nasal sinus cancer used in this report was 28.6 percent,[44] inferring that two hospitalizations and one death were attributable to

SHS in Marion County. The resulting cost estimate was $735,000, which includes $50,000 hospitalization costs and $685,000 loss of life costs.

Heart Disease--Myocardial Infarction: The attributable risk for SHS-related myocardial infarction was 3.9 percent for hospitalizations and 6.9 percent for deaths.[2] Thus, nine hospitalizations and 30 deaths for myocardial infarction in Marion County may be attributed to SHS exposure, with a resulting total cost of $2.5 million, including $64,000 hospitalization and $2,460,000 loss of life costs.

Heart Disease--Arteriosclerosis: The attributable risk for SHS-related arteriosclerosis was estimated to be 16.7 percent for hospitalizations and 6.9 percent for mortality,[2] which projects to 69 hospitalizations and 66 deaths in Marion County. The resulting cost was estimated to be $1,451,000 for hospitalizations. Although SHS is a known contributor to deaths due to arteriosclerosis, the median age of death for these cases in Marion County in 1999 was higher than the life expectancy of 76.7 years. Thus, because of the method used in this study to determine costs associated with loss of life, there was no dollar value for SHS related arteriosclerosis loss of life in 1999.

Stroke: The attributable risk for stroke used in this report was 48 percent [44-45] resulting in an estimated 144 SHS-related hospitalizations and 115 SHS-related deaths in Marion County. This led to an estimated cost of $1,211,000 for hospitalizations in Marion County. SHS exposure is a known contributor to deaths due to strokes, however the median age of death for stroke cases in Marion County in 1999 was higher than the life expectancy of 76.7 years. Thus, because of the method used in this study to determine costs associated with loss of life, there was no dollar value for SHS related loss of life due to strokes in 1999.

Cervical Cancer: The attributable risk used for SHS-related cervical cancer was 5.5 percent,[2] which resulted in an estimated four hospitalizations and one death in Marion County due to SHS. This led to an estimated total cost of $1.3 million for SHS attributable cervical cancer, with $62,000 for hospitalization and $1,240,000 for million loss of life.

Asthma: The SHS-related attributable risk for asthma was estimated to be 33 percent, [46] resulting in 518 hospitalizations and eight deaths in Marion County. This resulted in an estimated cost of $9.8 million, including $2,957,000 for hospitalizations and $6,831,000 million loss of life cost.

SHS CHILD MORBIDITY AND MORTALITY COSTS:

Table 2 presents the estimated incidence, attributable risk, and costs of health care and loss of life for SHS related medical conditions for children in Marion County. The overall costs of medical care for children in Marion County were estimated to be $10.5 million. The estimated loss of life costs for these same conditions were $20.3 million. Combined, the SHS attributable morbidity and mortality costs for children were estimated to total $30.9 million dollars in Marion County. These costs are distributed among the SHS related conditions as follows:

Sudden Infant Death Syndrome: Sudden Infant Death Syndrome is the third leading cause of death among infants in the United States, with an estimated 2,800 infant deaths per year in the U.S. [4] There were an estimated nine SIDS deaths in Marion County. Using an attributable risk of 36 percent, three of the SIDS deaths in Marion County may be attributed to SHS, resulting in $5,219,000 million loss of life costs.

Respiratory Syncytial Virus Bronchiolitis (RSV): Respiratory Syncytial Virus Bronchiolitis (RSV) is a leading cause of lower respiratory tract infection in infants and young children (age <2) [4] and led to an estimated 299 hospitalizations and 15 deaths in Marion County. An attributable risk of 25 percent [4] was used to determine the number of RSV hospitalizations and deaths that can be attributed to SHS exposure. This resulted in an estimated 76 hospitalizations and four deaths in children younger than two years old attributed to SHS exposure in Marion County. For RSV, the estimated cost per hospitalization was $7,710. The estimated total cost for SHS related RSV was $6.5 million, including $589,000 for hospitalizations and $5,924,000 for loss of life.

Acute Otitis Media: Acute otitis media is a frequently diagnosed pediatric ailment, as well as one of the most frequent reasons for physician visits, in children under 15 years of age.[4] In Marion County there was an estimated 74,500 office visits for acute otitis media. Using an attributable risk estimate of 14 percent ,[4] it is estimated that 10,560 office visits in children younger than fifteen for otitis media in Marion County each year can be attributed to SHS exposure. The estimated cost of the office visits (physician fees and medication) per case was $58. This leads to an estimated total cost of $607,000 for otitis media health care attributed to SHS exposure in Marion County.

Otitis Media with Effusion: Otitis media with effusion is a persistent middle ear infection and is often treated by insertion of an ear tube (tympanostomy).[4] Annually, it is estimated that 2,300 tympanostomies are performed in Marion County. Using a cost estimate of $3,528 per surgery and a attributable risk of 14 percent,[4] it is estimated that exposure to SHS led to 342 tympanostomy procedures with a resulting total cost of $1,205,000 in Marion County.

Asthma: Asthma is a leading cause of pediatric illness, resulting in 40,000 physician visits, 614 hospitalizations and 0.31 deaths among children under the age of 18 in Marion County each year. An attributable risk of 14 percent was used to determine the number of cases that may be attributed to SHS exposure.[4] This led to an estimated 5,527 physician visits, 86 hospitalizations, and 0.043 deaths due to asthma that can be attributed to SHS exposure. The average cost associated with pediatric asthma is $129 per case (physician fee, medication, and hospitalization). Thus, the estimated total cost for SHS related asthma care was $792,000, which includes $722,000 in total medical costs and $70,000 in loss of life costs in Marion County.

Burns: Burns and fires are a significant contributor to childhood morbidity and mortality. An estimated 52 hospitalizations and 920 outpatient visits for burns in children younger than 15 occurred in Marion County. Using an attributable risk of 14 percent,[4] it is estimated that there was one death, 31 outpatient visits and two hospitalizations in Marion County due to burns suffered from a fire caused by smoking. Additionally, it was estimated that one child died in Marion County due to burns suffered from a fire caused by smoking. The average costs of outpatient visits and hospitalization for children with burns was estimated to be $2,952. This led to an estimated total cost of $1,320,000 million in Marion County, which included $1,223,000 in loss of life costs and $97,000 in total medical costs.

Low Birth Weight: Low birth weight continues to be a significant public health problem in the United States, with 7.6 percent of all births occurring to children weighing less than 2,500 grams. Low birth weight accounts for a large proportion of infant deaths and significant long-term morbidity. Maternal smoking is a significant risk factor for

delivering a low birth weight infant, as it has been estimated that maternal smokers have close to double the risk of delivering a low birth weight infant than nonsmokers. For low birth weight associated with SHS exposure, the attributable risk was estimated to be18 percent [4]. Thus, it is estimated that 216 low birth weight cases in Marion County may be attributed to maternal smoking. The medical costs for caring for a low birth weight baby is estimated at $34,000 per case. The total cost of medical care for low birth weight deliveries attributed to maternal smoking in Marion County was estimated to be $7,327,000.

Perinatal Deaths: Maternal smoking is a risk factor for perinatal deaths, accounting for approximately five percent of all perinatal deaths.[4] In Marion County, five perinatal deaths may be attributed to SHS. The estimated loss of life cost was $1.57 million per case, which resulted in a total perinatal death loss of life cost of $7,875,000 in Marion County.

BUSINESS COSTS OF PRIMARY SMOKING:

As of the most recent (1999) U.S. Bureau of Economic Analysis report, there were 709,582 people employed in Marion County.[48] Applying the adult smoking rate in Marion County of 28.2 percent, it is estimated that 200,102 people employed in Marion County are smokers. Using the estimated costs to business of $1,300 (2000 dollars) per smoking employee, [37] the excess cost of smoking employees to Marion County businesses was estimated to be $260.1 million.

TOTAL COSTS OF SECONDHAND TOBACCO SMOKE IN MARION COUNTY:

The medical care cost of SHS attributable diseases among Marion County residents was estimated to be $6.2 million for adults and $10.5 million for children. The

estimated costs for the SHS attributable conditions for both adults and children are shown in Figure 1. The loss of life cost of SHS attributed diseases was estimated to be $19.2 million for adults and $20.3 million for children. The estimated number of deaths for SHS attributed conditions are shown in Figure 2 and the costs for loss of life are shown in Figure 3. Thus, the total economic impact on the health of Marion County residents was estimated to be $56.2 million. The economic impact of smoking employees on businesses, estimated to be $260.1 million. Together, the health costs of SHS and the added business costs from employees smoking in 2000 totals in excess of $316,300,000.

CONCLUSIONS

It is well known that tobacco use contributes to the increased incidence of disease and premature loss of life in those who smoke, however, many do not recognize the impact of smoking on his or her spouse, children, family members, friends, co-workers and customers. Exposure to SHS is not only a significant health concern, but a significant economic concern as well. During 2000, about 16.7 million dollars were spent for the hospitalization and health care of Marion County residents with SHS exposure-caused diseases: $6.2 million for adults and $10.5 million for children. Additionally, there was an approximate $39.5 million loss due to premature death that can be attributed to SHS exposure: $19.2 million for adults and $20.3 million for children. The cost of health care and the cost of premature loss of life for diseases attributed to SHS in Marion County were estimated to be at least $56.2 million in 2000. These costs do not include the health care and loss of life costs of Marion County residents who are smoking themselves.

In addition, businesses carry a significant economic burden when their employees smoke. Employees who smoke cost Marion County businesses an additional $260.1 million dollars in increased health insurance premiums, lost productivity, fires, absenteeism, and extra housekeeping costs.

The health impact and additional costs arising from SHS can be avoided or reduced in two ways. First and most obvious, the individual can quit smoking. Second, if a person continues to smoke tobacco, they should be discouraged from smoking in their home, their automobile, workplace, or in any other shared areas. Strong community policies should be enacted and enforced to prohibit smoking in any inside area or outside public area where people congregate. School, college and university administrators should ban smoking on their campuses by students, faculty and staff and strictly enforce that policy. Business owners and managers should also consider making their place of business smoke-free. Such policies need to have the support of the public and employees, which requires that they understand the magnitude of the consequences of SHS both from a health perspective as well as from an economic perspective.

The support of the public is needed to develop successful policy recommendations to restrict tobacco use. The Indianapolis Metropolitan Statistical Area (which includes Marion County) has the third highest adult smoking rate among the 99 metropolitan statistical areas studied.[50] Of the 20 states surveyed concerning SHS, Indiana was among the states having the lowest public support favoring restrictions on smoking, including smoke-free policies in work areas, no smoking in restaurants and prohibiting indoor smoking work areas.[51] A recent telephone survey of Marion County residents found that over half (52.2%) work in places where smoking is allowed in some or all of the work

area.[52] With the high incidence of smoking and the relatively weak policies and poor attitudes related to SHS, Marion County is at high risk for continuing to incur high SHS related costs if more effective policies related to SHS are not developed, supported, and implemented. Therefore, it is important that the results of this study be used to educate consumers, administrators, business owners, legislators and policy makers to make them more aware of the huge health and economic consequences of SHS at the community level.

RECOMMENDATIONS

Policy makers, administrators and business managers should use the results of this study to:

- Educate the public, as well as community leaders and policy makers, about the health impact and costs of SHS in Marion County;
- Develop strategies to totally eliminate smoking on business and institutional campuses including schools, colleges and universities, day care centers, restaurants and other food or beverage service establishments;
- Strictly enforce no smoking restrictions in all public areas, and on business and school campuses;
- Provide more support for smoking cessation by businesses, health departments and health care providers; and,
- Encourage smokers not to smoke in shared areas.

FURTHER RESEARCH NEEDED

There are several limitations to this study, addressed in the methods section that could be remedied with future studies. First, researchers need to further investigate other diseases to determine if they are attributable to SHS exposure so that the full impact of SHS exposure on human health is identified. Second, outpatient medical care, pharmacy and indirect costs need to be collected to calculate the full costs of SHS exposure on human health. Third, the costs of employee smoking were based on 1980 figures; more current figures may result in different results as the nation shifts more from a manufacturing to a service economy. Fourth, studies focused on Marion County residents and businesses are needed to measure the impact and costs of SHS exposure on the health care and businesses here, which would remove concerns about inferring values from studies conducted in other geographical areas. Fifth, there is a need for health and medical researchers to include measuring exposure to SHS in their study designs to not only better understand the impact of that exposure, but to properly control for this confounding factor.[53] In conclusion, even though the cost estimates in this report are underestimated due to data limitations, they provide a significant rationale to reduce the rate of smoking and prevent exposure to SHS in Marion County.

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Tables

TABLE 1

Incidence, Attributable Risk, Number of Deaths and Hospitalizations, and Costs for Selected Secondhand Smoke (SHS) Related Conditions for Adults - Marion County

Disease	Incidence (1999)	Attributable Risk	# Deaths and # Hospitalizations due to SHS exposure	Costs of Hospitalization (Adjusted to 2000 Dollars)	Total Cost (Adjusted to 2000 Dollars)
Lung Cancer	508 hospitalizations 590 deaths	AR = 4.9%	25 hospitalizations 29 deaths	$16,509 per hospitalization	$411,000 hospitalization $7,974,000 loss of life
Nasal Sinus Cancer	7 hospitalizations 3 deaths	AR = 28.6%	2 hospitalizations 1 death	$24,949 per hospitalization	$50,000 hospitalization $685,000 loss of life
Heart Disease	Myocardial Infarction: 240 hospitalizations 430 deaths	AR = 3.9% AR = 6.9%	9 hospitalizations 30 deaths	$6,843 per hospitalization	$64,000 hospitalization $2,460,000 loss of life
	Arteriosclerosis: 414 hospitalizations 962 deaths	AR = 16.7% AR = 6.9%	69 hospitalizations 66 deaths	$20,982 per hospitalization	$1,451,000 hospitalization *
Stroke	300 hospitalizations 240 deaths	AR = 48.0%	144 hospitalizations 115 deaths	$8,409 per hospitalization	$1,211,000 hospitalization *
Cervical Cancer	65 hospitalizations 13 deaths	AR = 5.5%	4 hospitalizations 1 death	$17,226 per hospitalization	$62,000 hospitalization $1,240,000 loss of life
Asthma	1571 hospitalizations 16 deaths	AR = 33.0%	518 hospitalizations 8 deaths	$5,704 per hospitalization	$2,957,000 hospitalization $6,831,000 loss of life
Total Hospitalization Costs					$6,206,000
Total Loss of Life Costs					$19,190,000
Total Costs					$25,396,000

* The median age at death for arteriosclerosis and stroke cases in Marion County exceeded the life expectancy value used in the calculation of percent of life lost, thus, there were no costs for loss of life for these diseases.

TABLE 2

Incidence, Attributable Risk, Number of Deaths and Hospitalizations, and Costs for Selected Secondhand Smoke (SHS) Related Conditions for Children - Marion County

Disease	Incidence (2000)	Atrributable Risk	# Deaths & Health Care Utilization due to SHS exposure	Costs per Case (Adjusted to 2000 Dollars)	Total Cost (Adjusted to 2000 Dollars)
Sudden Infant Death Syndrome; age <1	9 SIDS deaths	AR = 36%	3 deaths	$1,611,000 loss of life	$5,219,000 loss of life
Respiratory Syncytial Virus Bronchiolitis age < 3	299 hospitalizations 15 deaths	AR = 25%	76 hospitalizations 4 deaths	$7710 per hospitalization $1,623,000 loss of life	$589,000 hospitalization $5,924,000 loss of life
Acute Otitis Media age <15	74,500 office visits	AR = 14%	10,560 office visits	$58 per case for office visits	$607,000 medical
Otitis Media with Effusion age <15	2300 surgeries	AR = 14%	342 surgeries	$3528 per surgery	$1,205,000 surgical
Asthma age < 18	40,000 office visits 614 hospitalizations 0.31 deaths	AR = 14%	5527 office visits 86 hospitalizations .043 deaths	$129 per case for office visits and hospitalizations $1,623,000 loss of life	$722,000 medical $70,000 loss of life
Burns age < 15	920 outpatient visits 52 hospitalizations	AR = 14%	31 outpatient visits 2 hospitalizations 1 death	$2952 per case for outpatient visits and hospitalizations $1.575 million loss of life	$97,000 medical $1,223,000 loss of life
Low Birth Weight (LBW)	1,198 LBW births	AR = 18%	216 LBW births	$34,000 medical costs per case	$7,327,000 medical
Perinatal Death age < 1 mo	100 perinatal deaths	AR = 5%	5 perinatal deaths	$1,575,000 loss of life	$7,875,000 loss of life
Total Health Care Costs					$10,547,000
Total Loss of Life Costs					$20,311,000
Total Costs					$30,858,000

Figures

Figure 1
Estimated Medical Care Costs for Diseases Attributed to Secondhand Smoke in Marion County
Adults and Children
2000

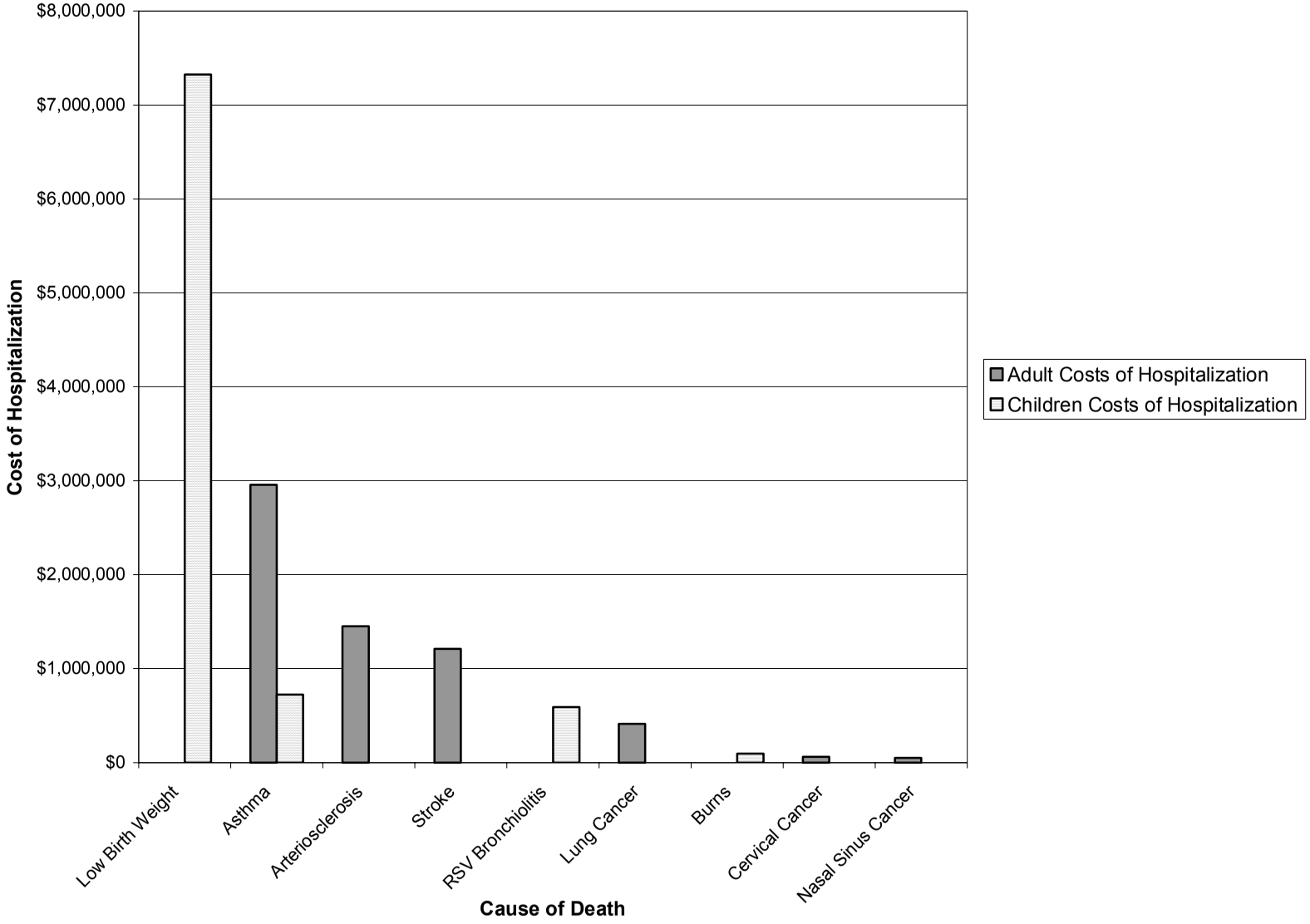

Figure 2
Estimated Number of Deaths in Marion County Attributed to Secondhand Smoke
Adults and Children
2000

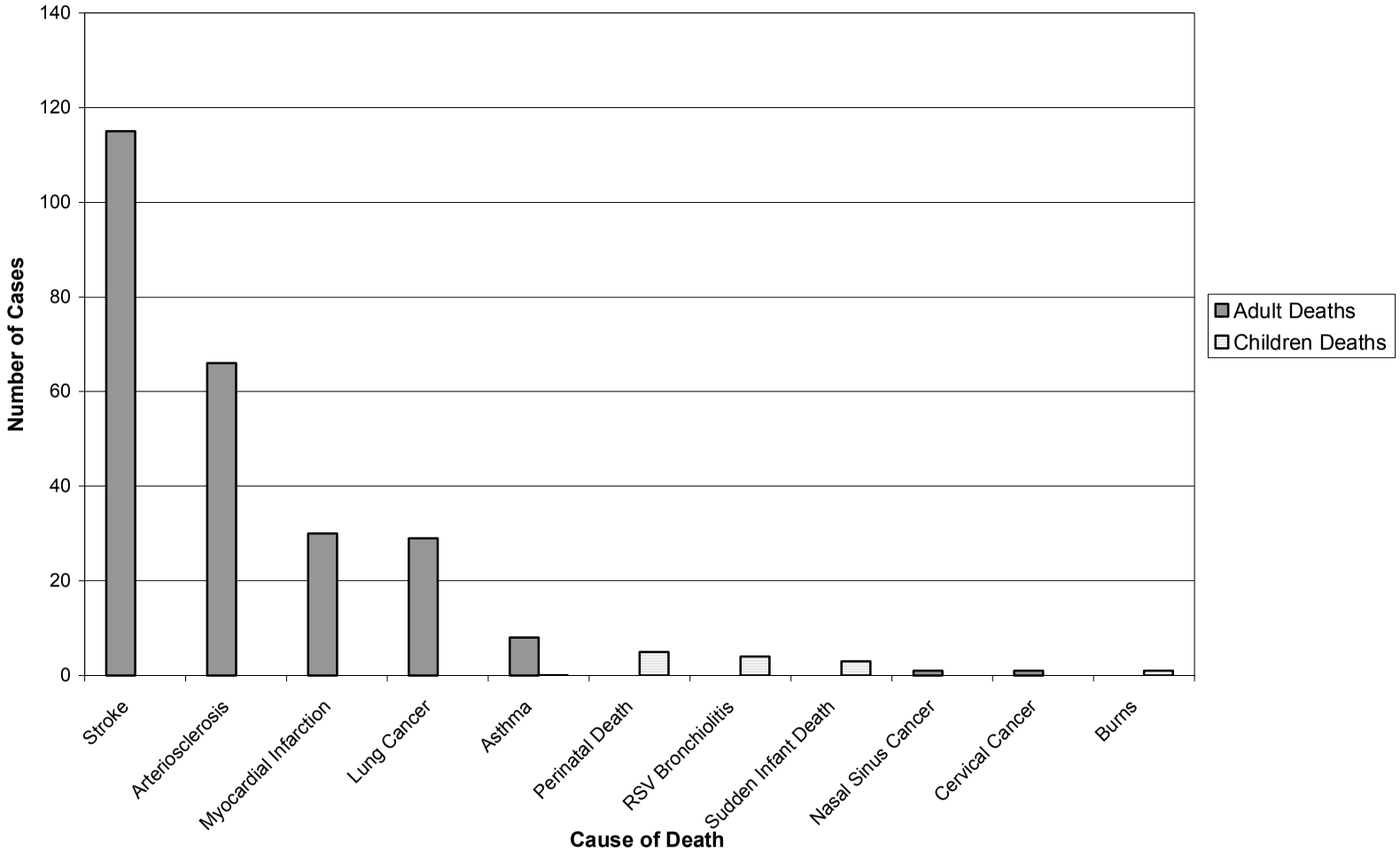

Figure 3
Loss of Life Costs for Diseases Attributed to Secondhand Smoke in Marion County
Adult and Children
2000